# Space Weather Technical Forecast

Issued on Tuesday, 25 June 2024 at 01:22 Local

**This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

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**GOES16/18 satellite data feeds are currently experiencing a data gap since approximately 24/2120 UTC, as a result our Alerts and Warnings service may experience delays or contain incomplete data.**

**Space Weather Forecast Headline: Further M-class flares likely, with a slight chance of X-class flares.**

**Analysis of Space Weather Activity over past 24 hours**

**Solar Activity:** Solar activity has been Moderate, with a number of low M-class flares in the past 24 hours, including a sustained period with the background flux frequently into M-class, between 24/0412 UTC and 24/0712 UTC. Peak flare was M1.8 at 24/0452 UTC, from AR3612 just over the southwest limb. There are eleven sunspot regions now on the disc, with AR3712 and AR3713 now rotated away over the west limb, and AR3716 soon following. AR3723 remains a complex, longitudinally wide region, and further details are likely to become apparent as it rotates further into view. Some slow growth has also been observed in AR3720, although this is now maturing into a slightly simpler region. GOES16/18 data feeds are currently experiencing a data gap since approximately 24/2120 UTC, as such the above based on the best data at time of issue.

Multiple CMEs have been observed, although none have been assessed as having a significant Earth directed component, with the large CME associated the very long period M-flare from over the southeast limb assessed as passing clearly ahead of Earth's orbit. A potentially significant filament disruptions appears to be ongoing at time of issue in the southwest disk however, any resultant CME will be assessed if and when it becomes visible.

**Solar Wind / Geomagnetic Activity:** Background slow wind conditions were observed but with a weak transient feature observed from 24/1720 UTC. Solar wind speeds observed by ACE at L1, were at background easing from around 340 km/s to near 310km/s. Density was below average. The Interplanetary Magnetic Field, Bt, was weak average around 3-4nT, but saw an increase to average around 5-6nT following the transient arrival. North-south component, Bz, was weak, varying between +4 and -3 nT, and favoring a positive (northward) direction. Phi angle was predominantly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

**Energetic Particles / Solar Radiation:** The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels with no solar radiation storms occurring although it showed a slight increase towards the end of the period. High energy electron flux (greater than 2MeV) observed by GOES16 was at background. The 24-hour fluence remained below Active, reaching 1.45e6 integrated pfu at 25/0000 UTC. GOES16/18 data feeds are currently experiencing a data gap since approximately 24/2120 UTC, as such the above based on the best data at time of issue.

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# Met Office Space Weather Technical Forecast

**Four-Day Space Weather Forecast Summary**

**Solar Activity:** Further M-flares are likely, with a slight chance of isolated X-class flares. These most likely from either the recently departed sunspots in the far west in the near term, or increasingly AR3623 in the southeast.

**Solar Wind / Geomagnetic Activity:** There are no CMEs currently assessed as significantly Earth-directed, although there is a very slight chance of a glancing interaction from a CME on day 3 (27 Jun), due to a southwest disc filament lift on 23 Jun. Otherwise solar winds are expected to remain near background with no notable enhancements forecast. Geomagnetic activity is forecast to be mainly Quiet, with only isolated Unsettled intervals. Any CME arrivals later in the period bring a slightly increased risk of Active to G1 Minor Storm intervals.

**Energetic Particles / Solar Radiation:** High energy proton flux is expected to remain at background, with a slight and declining chance of exceeding the S1/Minor Storm threshold should any notable flares occur from any of the three large sunspots now around the western limb. High energy electron flux is forecast to be at background. The associated 24-hour fluence is expected to remain well below the Active threshold.

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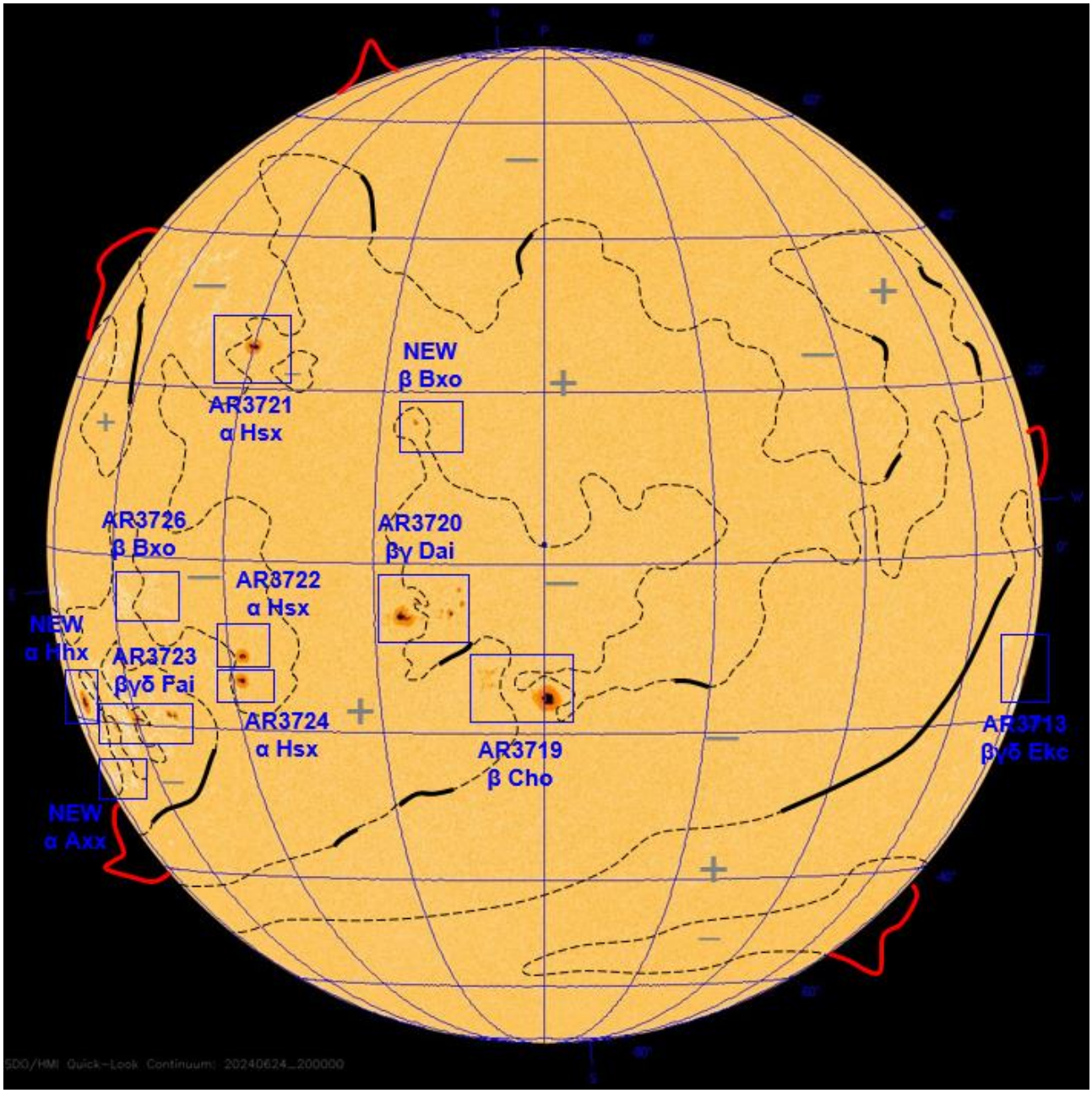
**Figure 1. Solar Analysis Valid 24/2000 UTC.**




**Key:** Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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## Geomagnetic Storms:

There are currently no CMEs assessed as being significantly Earth-directed. However a CME associated with a filament eruption on 23 Jun is expected to miss just behind and south of Earth, but some weak glancing influence cannot be completely ruled out late on day 3 (27 Jun). Further filament eruption are also possible in the coming days given a number of large filaments currently on the visible disk.

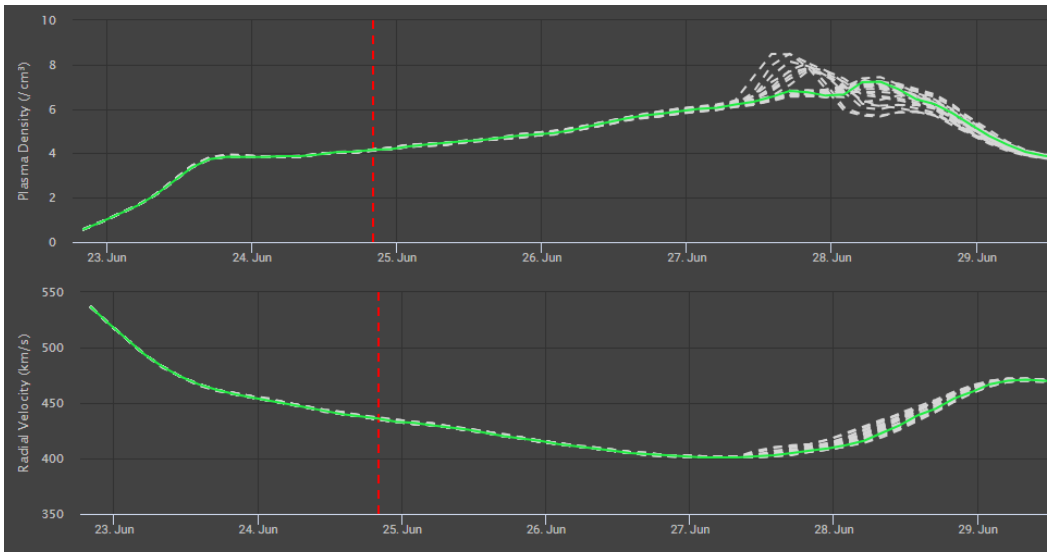
Aside from any CME arrival, solar winds are expected to remain indicative of a slow background flow with no coronal holes of note currently on the Earth-facing disc. Solar wind speeds are likely to persist at background with geomagnetic activity forecast to be mainly Quiet, with a chance of isolated Unsettled intervals. Any glancing CME arrivals later in the period bring a slightly increased risk of Active to G1 Minor Storm intervals.

| Geo-Magnetic Storm Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 1 | 1 | 10 | 10 |
| Strong | G3 | No | 1 | 1 | 1 | 1 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

## Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil

**Figure 2: Latest MOSWOC ENLIL ensemble output, solar wind speeds generally overestimated but viewed as generally good guidance,**

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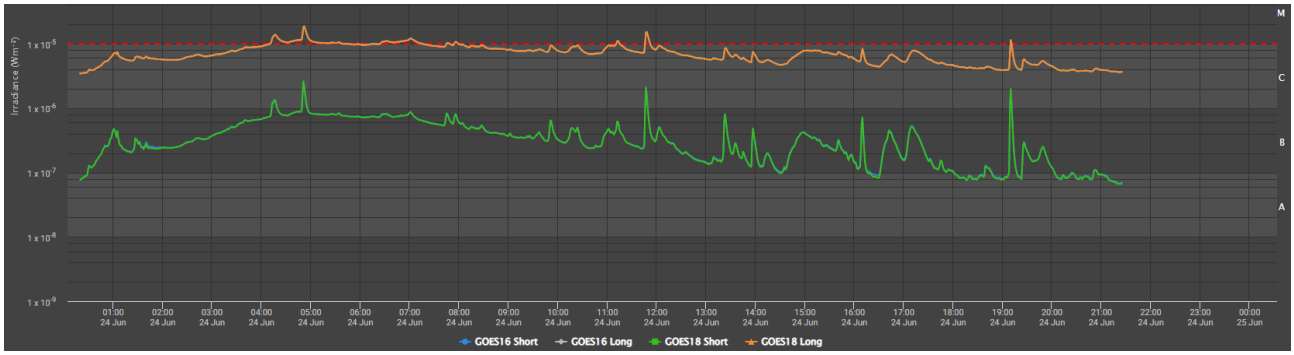
**Radio Blackouts - X-Ray Flares:**
Generally Moderate activity is expected to start the period, with a slowly decreasing flare risk as AR3712/AR3713 continue to rotate away and AR3716 imminently rotates off the disc. The chance of M-class flares, and a slight chance of isolated X-class flares is maintained throughout the period however, chiefly due to AR3723 rotating onto the east limb.

AR3723, which is likely formed from the remnants of ex-AR3697/3664, along with its large surrounding plage area and smaller spots, forms a complex area of notable looping on the southeast disc. While the spot appears rather ragged, and limited in size, there is a clear delta configuration through its intermediate regions. Far-side products also suggest the potential for further spots to rotate onto the disc in the coming days, although this is low confidence.

| X Ray Flares | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability | | | (%) | (%) | (%) | (%) |
| Active | R1-R2 M Class | Yes | 70 | 60 | 50 | 50 |
| Very Active | R3 to R5 X Class | No | 15 | 10 | 10 | 10 |

**Figure 3: Latest 24hr GOES16/18 X-ray trace, data outage visible in recent hours.**

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**Solar Radiation Storms - (High Energy Protons):**
GOES-18 high energy protons are slightly above background levels, likely due to a resent flare and CME from AR3716 rounding the west limb. AR3712 and AR3713 also remain close to the west limb to start the period as they continue to rotate away, and each of these provides some potential connected to Earth, due to the Parker Spiral, with any significant proton release have the potential to be observed at GEO, bringing a slight chance of reaching the S1 Minor Radiation Storm threshold. This risk receding as these regions retreat further onto the far-side into the start of the period, only somewhat rising again by day 4 (29 Jun) as regions currently emerging over the southeastern limb begin to approach centre disk.

| Radiation Storms Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ S1** | No | 15 | 10 | 5 | 10 |
| **Very Active** | **≥ S3 *** | No | 1 | 1 | 1 | 1 |

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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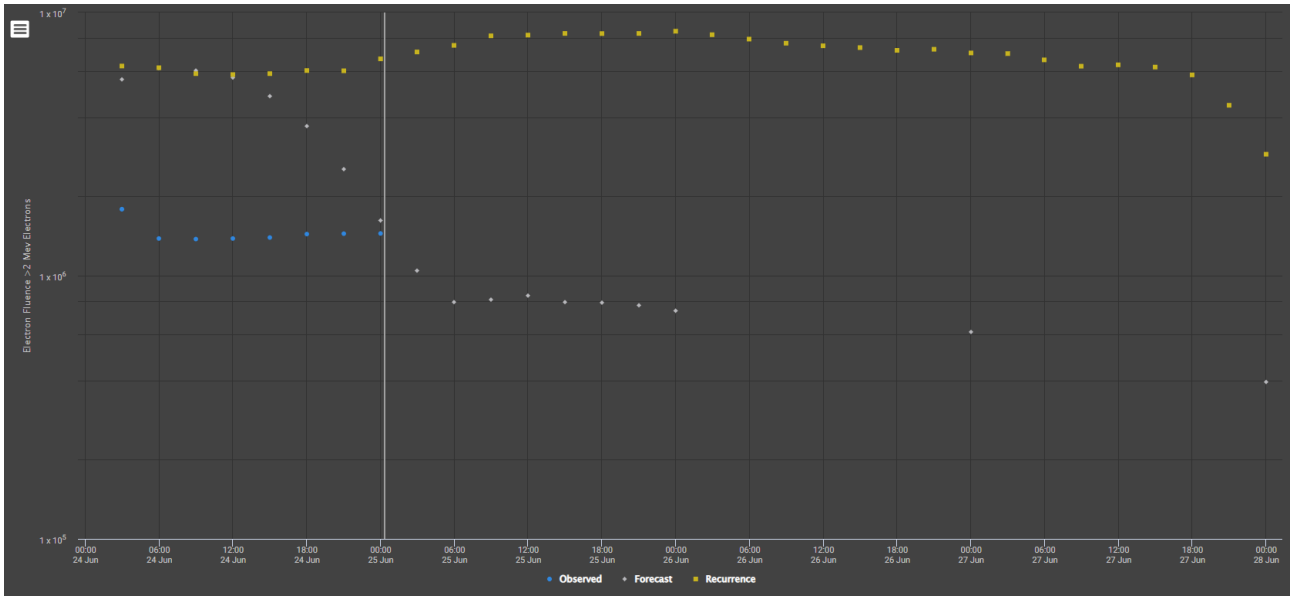
**High Energy Electrons Event (≥ 2MeV):**
High energy electron flux, as observed by GOES-16, has been at background. With no notable sources of enhancement forecast, flux is expected to persist at this level.

Associated electron fluence is expected to persist well below the Active threshold (1e8 integrated pfu), with MOSWOC REFM output considered to be giving good guidance.

| GEO Electron Environment<br>Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $day^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC)<br>(%) | Day 2 (00-24 UTC)<br>(%) | Day 3 (00-24 UTC)<br>(%) | Day 4 (00-24 UTC)<br>(%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ 2 MeV ≥ $1x10^8$** | No | 1 | 1 | 1 | 1 |
| **Very Active** | **≥ 2 MeV ≥ $1x10^9$** | No | 1 | 1 | 1 | 1 |

**Figure 4: Latest MOSWOC REFM output.**

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